Original Article ISSN (O):2395-2822; ISSN (P):2395-2814

A Retrospective Study of Histopathology and Clinical Correlation of Spinal Meningioma at Thoothukudi Medical College, India.

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Received: August 2019
Accepted: August 2019

ABSTRACT

Background: The study was conducted to understand the clinical algorithm of spinal meningioma. Correlation was done by clinical presentation with radiological features and histopathology .The stress upon to understand the necessity for a team-approach between Clinician, Radiologist and Pathologist and vice versa is emphasised. Aim: To correlate histopathology of spinal meningioma with the Clinical features. **Methods:** This is a retrospective study of spinal tumours, diagnosed by histopathology as various types of meningioma. All the relevant clinical data of the patients were searched from the ward records. The various Radiological features were collected. **Results:** The total number of spinal tumours studied during the 8 years period was 86 cases among which 25 cases were diagnosed by histopathology as various types of meningioma conclusively. Spectroscopy provides molecular information with regard to meningiomas and potentially aid in biopsy planning. Surgical resections were done as follows: 20 cases resected as Simpson Grade 1, 5 cases resected as Simpson Grade 2. Venous thromboembolism was seen in 1 patient. Four cases underwent follow up Adjuvant External Beam Radiotherapy. **Conclusion:** The Simpson grading of resection of meningioma correlated the degree of surgical resection completeness with symptomatic recurrence. Four cases underwent follow up Adjuvant External Beam Radiotherapy with good results .Spinal meningioma needs correlation between Radiologist, Pathologist and Clinician.

Keywords: Radiograph, CT, MRI, H&E Stain, Simpson grading of resection, Adjuvant External Beam Radiotherapy.

INTRODUCTION

Meningiomas, which arise from arachnoid cap (meningothelial) cells, are one of the most frequent primary intraspinal neoplasm is approximately five per million for females and three per million for males. Spinal meningiomas most often affect middle-aged women. The second most common intradural extramedullary spinal tumour representing 25% of all such tumours. Meningiomas are often located posterolaterally in the thoracic region and anteriorly in the cervical region. We found that spinal meningiomas were located lateral to the spinal cord or had a component that extended laterally. A posterior location was more frequent than an anterior one. Typically, back or radicular pain preceded the weakness and sensory changes; the sphincter dysfunction was always a late finding. The incidence of meningioma is due to exposure to environmental risk factors or sensitive diagnostic modalities, there is a relationship between age, sex, pathological subtype and location of meningioma.[1] An estimated 0.5 % of the population has an incidental asymptomatic spinal meningioma in autopsy studies.[2] With the wider use of CT and MRI, many meningiomas are discovered as incidental findings during investigation for unrelated symptoms.[3] Gingko leaf sign is seen on axial post contrast T1 imaging, with the leaf representing the distorted spinal cord, pushed to one side of the theca by the meningioma, and the stem, seen as a non-enhancing 'streak', probably representing the stretched dentate ligament.[4] Sex, age, initial tumour size, and calcification were reported to be related to the tumour growth judging from follow-up scans.[5] The prevalence of tumour invasion of the dural tail has been reported (0-100%), with generally higher prevalence in WHO II (atypical) meningiomas.[6] This is further complicated by the presence of tumour cells in apparently normal dura adjacent to tumours . Whether or not the dural tail should be resected and if so how much surrounding dura should be included in the resection continues to be debated.[7] A broad division of meningiomas is into primary intradural (which may or may not have

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secondary extradural extension) and primary extradural (rare) Pregnancy is associated with high incidence of spinal meningioma.[8] Intradural extramedullary neoplasms are located outside the spinal cord but within the dural sheath. Extradural spinal meningioma arise outside the dural covering of the spinal cord. Meningiomas are categorized into three World Health Organization (WHO) grades with 16 histological subtypes. Meningiomas are closely associated with the tumour suppressor syndrome NF2, with 50–75% of individuals with NF2 developing a meningioma during their lifetime, associated with obesity.[9] Meningiomas are the most common extra-axial primary spinal tumour.[10] Although a majority of these tumours are low grade, a significant proportion will recur after initial treatment surgical resection.[11] Literature published since the WHO 2000 classification report higher recurrence rates at five years following surgical excision for WHO grade II (41%),[12] and 70–91%)for grade III (than for WHO grade I lesions (3%) . Primary intraosseous meningioma is a term used to describe a subset of these extradural meningiomas that arise in bone.[13] The second most common intradural extramedullary spinal tumour (Meningiomas) representing 25% of all such tumours.[14]

AIM

To correlate histopathology of spinal meningiomas with the Cliniccal features.

MATERIALS AND METHODS

This retrospective study was conducted in Department of Pathology, Thoothukudi Medical College Hospital. We reported 86 cases of primary spinal tumours among which 25 cases were various types of spinal meningioma by histopathology conclusively. All the relevant clinical data of the patients were searched from the ward records. Parameters used to assess were age, sex, tumour location, pathological subtype, Simpson grade of surgical excision, tumour recurrence or progression during follow-up, VTE in the follow-up period survival time. A detailed health profile on general condition was taken and recorded.

RESULTS

Meningioma commonly involved thoracic region and cervical regions in the study. Meningothelial meningioma and psammomatous meningioma were the common subtypes observed. [Table 1]

Table 1: Distribution of Tumour Locations, and Histopathological Subtypes of Spinal Meningioma

Location	Cervical	Thoracic	Lumbar	Sacral	Total
Types					
Meningothelial	1	6	0	0	7
Fibrous	1	2	0	0	3
Transitional	1	2	0	0	3
Angiomatous	1	1	0	0	2
Psammomatous	1	6	0	0	7
Atypical	0	2	0	0	2
Anaplastic	0	1	0	0	1
Total	5	20	0	0	25

T1 weighted MRI Scan shows meningioma as an isointense lesion, contrast enhanced T1weighted scan shows enhancement of the lesion and T2 weighted scan shows meningioma as a high signal intensity lesion. The histopathological finding varies with the grades. [Table 2]

Table 2: Correlation study of Spinal Meningioma

Tumour	Radiographic Findings	Histopathological Findings
Meningothelial meningioma	MRI shows a well defined enhancing intradural extramedullary mass at the T2/T3 level causing severe compression	Section studied shows spindly-looking cells with pink cytoplasm run in short fascicles, forming syncytial structures and whorls, better appreciated at the centre of the photomicrograph. The cells may be arranged in lobules separated by fibrovascular septa.
Fibroblastic meningioma	MRI shows a 1.4 cm well defined ovoid intradural , extramedullary mass at the level of T8 .The mass is T1 isointense , T2 mild hyperintense with mild-moderate ,homogenous contrast enhancement displacing the cord to the left .	Section studied shows elongated cells and spindly nuclei. At the right upper corner, a fascicle has been cut horizontally. In this field the bland cytology of meningothelial cells is better appreciated.
Transitional meningioma	MRI scan shows a dural-based mass, located posterior to the thoracic cord, markedly compressing it. It is iso-intense to cord tissue on both T1 and T2 weighted images, and demonstrates vivid contrast enhancement. Dural tails are seen extending above and below the lesion.	Section studied shows meningothelial cells with fibroblastic appearance on the right and forming syncytial structures on the left. Abundant pink cytoplasm, indistinguishable cell membranes and bland nuclear features can be readily noted.
Angiomatous meningioma	MRI shows an extramedullary, oval lesion at T10/11 level. It is isointense on T1 and there is moderate enhancement. The spinal cord is displaced anteriorly. The coronal view shows the lesion displacing the cord to left.	Section studied shows uniform evenly spaced meningothelial cells with indistinct borders, bland nuclear cytologic features, fine open chromatin, and inconspicuous nucleoli. Occasional hyperchromatic nuclei are

		present. Multiple ovoid to round shaped vascular spaces lined by a monolayer of endothelial cells can be noted.
Psammomatous Meningioma	MRI shows within the spinal canal at T9 is a slightly hyperintense on T1, iso-intense on T2 intensely enhancing extra medullary intra dural mass measuring 10 x 13 x 16 mm in orthogonal planes. The lesion displaces the spinal cord towards the right with complete effacement of the CSF signal at this level and significant cord compression.	Section studied shows numerous psammoma bodies are seen in this variant. Psammoma bodies in the right one-third are more heavily calcified than the rest.
Atypical meningioma	MRI scan shows a lesion within the spinal canal at T9 is a slightly hyperintense on T1, iso-intense on T2 intensely enhancing extra medullary intra dural mass. The lesion displaces the spinal cord towards the right with complete effacement of the CSF signal at this level and significant cord compression.	Section studied shows the classic concentric calcifications. Psammomatous meningiomas need to have over half of the tumour mass composed of psammoma bodies and underlying meningothelial cells.
Anaplastic meningioma	MRI shows a large extramedullary intradural mass at T1 level markedly compressing the spinal cord. It shows homogenous enhancement, heterogenous high signal on the T2 weighted sequence.	Section studied shows the tumour displays hypercellularity, prominent nucleoli, nuclear pleomorphism, and sarcoma-like morphology.

Meningioma:

Meningiomas occur most commonly after the fifth decade of life. Females are affected far more commonly than males in ratio of 4:1. The gross appearence of the typical meningioma is a solid, lobulated, or globose mass broadly attached to the duramater. On sectioning, most meningiomas are grayish-tan and soft, but collagenized, have a rubbery texture and a whorled or trabeculated cut surface, whereas variants rich in stromal mucopolysaccharides acquire a somewhat gelatinous consistency. Calcification is often readily apparent and infiltration by foamy macrophages reflect the accumulation of lipids within tumour cells. Factors that may influence the aetiology of peritumoral edema include tumour size, histological subtypes, vascularity, venous stasis, and dural invasion. Loss of chromosome 22 occurs in recurrent and atypical meningiomas. Approximately half of meningiomas exhibit allelic loss that involves band q12 on chromosome 22.

The NF2 gene that resides in this region on chromosome 22q is a tumour suppressor gene involved in sporadic and NF2- associated meningioma tumourigenesis. Mutations in NF2 gene is associated with sporadic meningioma, fibrous meningioma, transitional meningioma, meningothelial meningioma, atypical and anaplastic meningiomas.

Behaviour is coded /0 for benign tumours, /1 for low or uncertain malignant potential or borderline malignancy, /2 for in situ lesions, and /3 for malignant tumours. [Table 3]

Table 3: Morphology code of the International Classification of Diseases for Oncology (ICD-O) of Intracranial Meningioma

Disease	Code
Meningothelial meningioma	9531/0
Fibrous (fibroblastic) meningioma	9532/0
Transitional (mixed) meningioma	9537/0
Psammomatous meningioma	9533/0
Angiomatous meningioma	9534/0
Microcystic meningioma	9530/0
Secretory meningioma	9530/0
Lymphoplasmacyte-rich meningioma	9530/0
Metaplastic meningioma	9530/0
Clear cell meningioma	9538/1
Chordoid meningioma	9538/1
Atypical meningioma	9539/1
Papillary meningioma	9538/3
Rhabdoid meningioma	9538/3
Anaplastic meningioma	9530/3

Table 4: Detailed Age Group, Sex Distribution, and Detailed History of the Cases

Tumour type	Age group	M:F Ratio	Signs and Symptoms
Meningothelial meningioma	Females range from 56-74 years of age old and the age involved in male was 59 years of age old	6:1	History of weakness or numbness in the arms or legs, and/or difficulty with bladder, bowel and/or sexual function
Fibroblastic meningioma	Females range from 52-67 years of age old and the age group involved in males 72 years of age old	2:1	History of back or radicular pain preceded the weakness and sensory changes; the sphincter dysfunction
Transitional meningioma	Females range from 56-68 years of age old and the age group male is 67 years of age old.	2:1	History of weakness or numbness in the arms or legs

Angiomatous meningioma	Female is 62 years of age old and the age group involved in male 56 years of age old .	1:1	History of difficulty with bladder, bowel and/or sexual function
Psammomatous meningioma	Females range from 56-74 years of age old and the age involved in male was 59 years of age old	6:1	History of weakness or numbness in the arms or legs, and/or difficulty with bladder, bowel and/or sexual function
Atypical meningioma	Female is 67 years of age old and the age group involved in male.	1:1	History of difficulty with bladder, bowel and/or sexual function.
Anaplastic meningioma	Female case is 68 years of age old.	1:0	History of weakness or numbness in the arms or legs

Treatment for intracranial meningioma:

Surgery for Spinal meningioma: The prone position for all spinal tumours, including those in the cervical region. It is important to localize the correct level by x-ray. In cases in which meningiomas were located anteriorly the laminectomy was extended laterally toward the articular process to provide sufficient exposure and cause minimal displacement underwent classic posterior of the spinal cord. The key considerations in the operation include the following. Adequate exposure above and below the tumour and on the ipsilateral side is needed. Careful removal of laminae is important particularly when there is an indication that the tumour is calcified. This may be facilitated by drilling a groove at the lateral edge of the lamina on each side and then lifting the lamina up while the yellow ligament attachments are divided. The dura is opened laterally over the tumour. Internal and/or lateral decompression of the tumour is performed before trying to dissect the tumour away from the spinal cord. Division of the dentate ligament attachments and/or a posterior nerve root in the thoracic region may facilitate removal. When the tumour is posterior lateral, the dural attachment is excised and the defect is repaired with a piece of fascia. In the more common anterior lateral tumours, resection of dura may be difficult without risk of injury to the ventral nerve roots or spinal cord. Calcified meningiomas were also difficult to resect because of adhesions to the spinal cord. Excellent results have been reported by several neurosurgeons using microsurgical techniques. Laminectomy is replaced by osteoplastic laminotomy with reconstruction of the posterior spinal column. The dural attachment was completely resected if the spinal meningioma was located dorsally or dorsolaterally. In these cases, duraplasty was performed with autologeous fascia obtained during the operative approach. In ventrally located tumours the dural attachment was not excised but extensively bipolar cauterized. Somatosensory evoked potentials were routinely monitored in each of the patients. Patients with malignant meningiomas underwent external-beam radiation therapy alone or in combination with chemotherapy after surgery. CSF leakage, wound complications, and transient deterioration of neurological status were the most common postoperative complications. The most frequent cause of death during the postoperative period was pulmonary embolism.

The Simpson grade of meningioma resection was described in 1957 and correlated the degree of surgical resection completeness with symptomatic recurrence. The type of resection still plays a part in the likelihood of symptomatic recurrence, other factors (such as the MIB-1 index) are also important, particularly in grades I - III. [Table 4]

Table 5: The Simpson grade of meningioma resection

Simpson grade	Definition	10-Year recurrence rate
1	Macroscopic gross-total resection with excision of dura , sinus ,and bone .	9%
2	Macroscopic gross-total resection with coagulation of dural attachment.	19%
3	Macroscopic resection without resection or coagulation of dural attachment.	29%
4	Subtotal resection.	40%
5	Biopsy.	Not available

Adjuvant Radiotherapy: Conventional external beam radiotherapy lacks the precision to allow delivery of large doses of radiation near radiosensitive structures such as the spinal cord. Tumour dose was maintained at 12 to 20 Gy. The CyberKnife system was found to be feasible, safe, and effective. The major potential benefits of radiosurgical ablation of spinal lesions are short treatment time in an outpatient setting with rapid recovery and symptomatic response. This technique offers a successful therapeutic modality for the treatment of a variety of spinal lesions as a primary treatment or for lesions not amenable to open surgical techniques, in medically inoperable patients, in lesions located in previously irradiated sites, or as an adjunct to surgery.

Chemotherapy for meningioma:

Hydroxyurea. Hydroxyurea is an oral ribonucleotide inhibitor that arrests the cell cycle in the S phase and induces apoptosis. Investigators are currently looking at the role of hydroxyurea as an adjunct to other therapies, such as radiation or calcium channel blockers. Pilot studies with radiation have shown some promise.

Trabectedin. This chemotherapeutic agent, is believed to work by binding to the minor groove of the DNA helix and inhibiting transcription factor

binding. Trabectedin was investigated in a preclinical study published by Preusser et al., which revealed a statistically significant response to treatment of various meningioma cell lines. The group subsequently treated a single, heavily pretreated patient with this chemotherapeutic agent was reported to have initial relief of his neurological symptoms and aphasia, and MRI revealed reduction of perifocal edema; however, treatment had to be terminated after 5 cycles due to side effects of generalized edema and mucositis. Additional, combinations of Adriamycin and decarbonize or isosfamide and mensa showed efficacy in some cases.

Meningotheliomatous Meningioma:

Seven cases of meningotheliomatous meningioma were reported. Six cases involving females and one case involving males. The age group involved in females range from 56-74 years of age old and the age involved in male was 59 years of age old. Six cases involved cervical region, one involved thoracic region and one case involved thoracic region. Six cases underwent Simpson grade 1 resection and one case underwent Simpson grade 2 resection one case underwent Adjuvant External Beam Radiotherapy Microscopically meningotheliomatous meningioma variants are the classic and common variant characterized by a lobular microarchitecture and are populated by cells having delicate round or oval nuclei. Common to these are tumour cells concentrically wrapped in tight whorls, pale nuclear "pseudoinclusions" and nuclear 'washing out' consisting of invaginated cytoplasm, and the lamellated calcospherules known as psammoma bodies.

MRI shows a well-defined enhancing intradural extramedullary mass at the T2/T3 level causing severe compression.

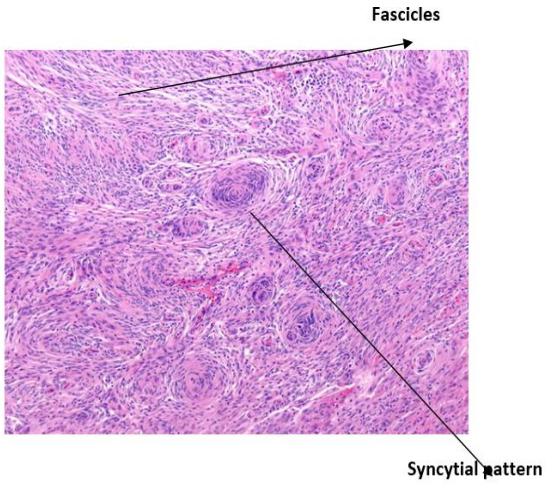

Figure 1: Section studied shows spindly-looking cells with pink cytoplasm run in short fascicles, forming syncytial structures and whorls, better appreciated at the center of the photomicrograph. The cells may be arranged in lobules separated by fibrovascular septa.

Meningothelial meningioma displaying a more relaxed fascicular and syncytial arrangements. Psammomatous calcifications can be appreciated in the center of the image. Fine collagenous septae appear intertwined with meningothelial cells.

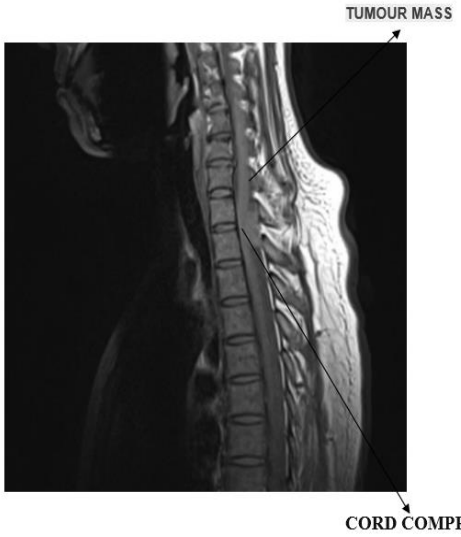

Figure 2: MRI shows a well defined enhancing intradural extramedullary mass at the T2/T3 level causing severe compression

Section studied shows spindly-looking cells with pink cytoplasm run in short fascicles, forming syncytial structures and whorls, better appreciated at the centre of the photomicrograph. The cells may be arranged in lobules separated by fibrovascular septa.

MRI scan shows an extradural mass with dural tail extending above and below it results in marked compression of the upper thoracic cord. The histopathology and radiology correlation was perfect in all the seven cases. [Figure 1 and 2]

Fibroblastic Meningioma

Three cases of fibroblastic meningioma were reported. Two cases involving females and one involving males. The age group involved in females range from 52-67 years of age old and the age group involved in males 72 years of age old. Two cases involved thoracic region, one involved thoracic region. All three cases underwent Simpson grade 1 resection. Fibroblastic meningioma is a common variant adopt a mesenchymal profile, being variably collagenized and consisting of spindle shaped tumour cells in interfascicular pattern. In fibroblastic meningioma the tumour cells form wide fascicles, with intercellular collagen and reticulin. The collagenous bands may be quite broad and may undergo dense calcification.

MRI shows a well-defined enhancing intradural extramedullary mass at the T2/T3 level causing severe compression

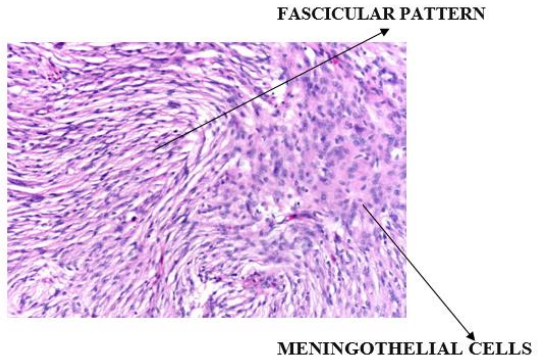

Figure 3: Section studied shows elongated cells and spindly nuclei. At the right upper corner, a fascicle has been cut horizontally. In this field the bland cytology of meningothelial cells is better appreciated.

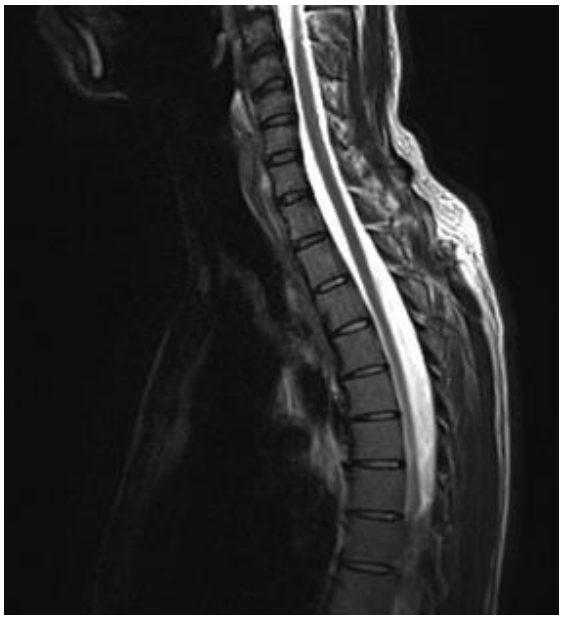

Figure 4: MRI shows a 1.4 cm well defined ovoid intradural , extramedullary mass at the level of T8 .The mass is T1 isointense , T2 mild hyperintense with mild-moderate ,homogenous contrast enhancement displacing the cord to the left .

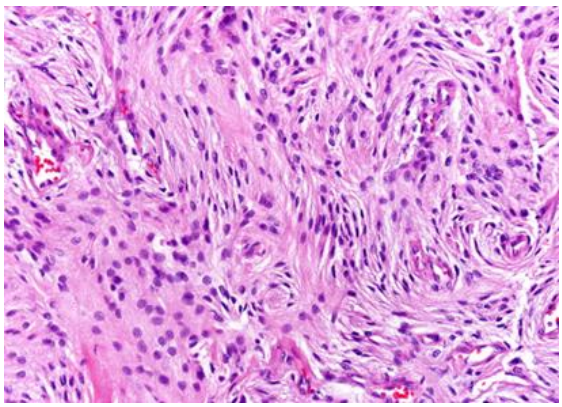

Figure 5: Section studied shows meningothelial cells with fibroblastic appearance on the right and forming syncytial structures on the left. Abundant pink cytoplasm, indistinguishable cell membranes and bland nuclear features can be readily noted.

Figure 6: MRI scan shows a dural-based mass, located posterior to the thoracic cord, markedly compressing it. It is iso-intense to cord tissue on both T1 and T2 weighted images, and demonstrates vivid contrast enhancement. Dural tails are seen extending above and below the lesion.

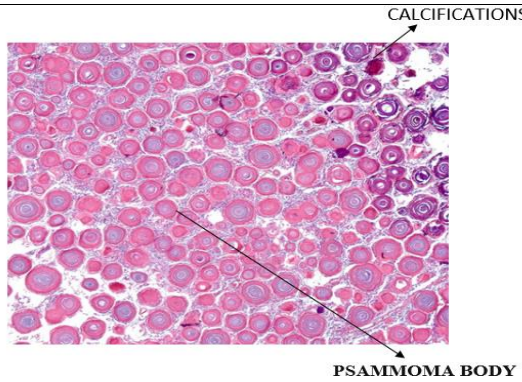

Figure 7: Section studied shows numerous psammoma bodies are seen in this variant. Psammoma bodies in the right one-third of the image are more heavily calcified than the rest.

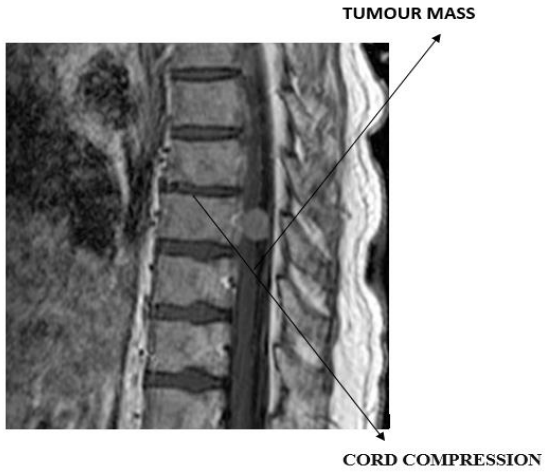

Figure 8: MRI shows within the spinal canal at T9 is a slightly hyperintense on T1, iso-intense on T2 intensely enhancing extra medullary intra dural mass measuring 10 x 13 x 16 mm in orthogonal planes. The lesion displaces the spinal cord towards the right with complete effacement of the CSF signal at this level and significant cord compression.

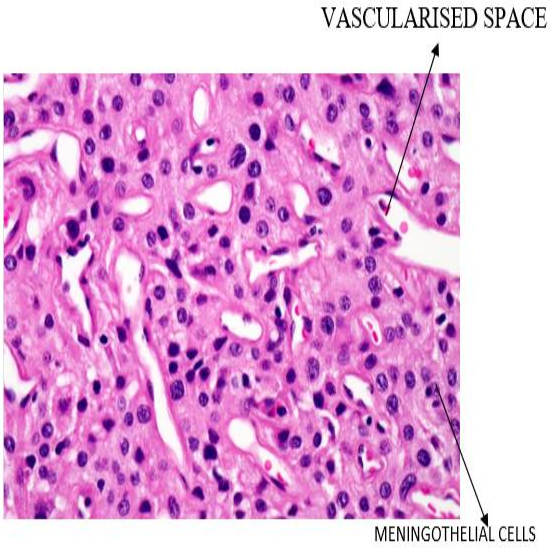

Figure 9: Section studied shows uniform evenly spaced meningothelial cells with indistinct borders, bland nuclear cytologic features, fine open chromatin, and inconspicuous nucleoli. Occasional hyperchromatic nuclei are present. Multiple ovoid to round shaped vascular spaces lined by a monolayer of endothelial cells can be noted.

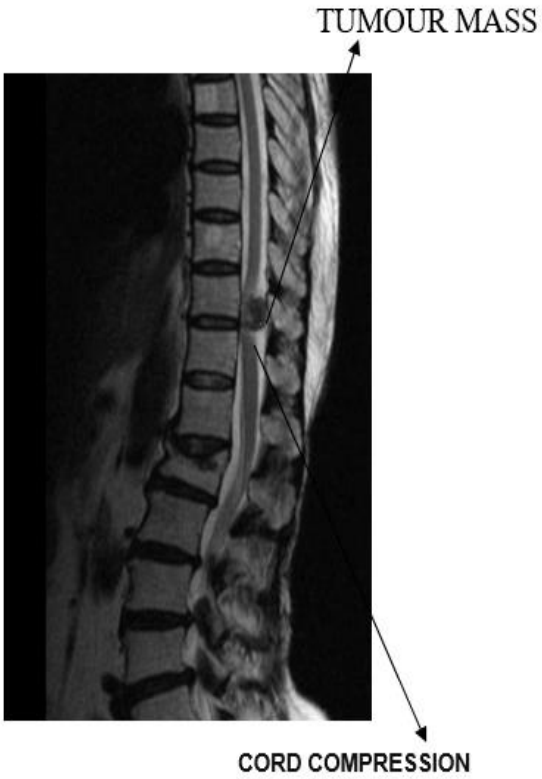

Figure 10: MRI shows an extramedullary, oval lesion at T10/11 level. It is isointense on T1 and there is moderate enhancement. The spinal cord is displaced anteriorly. The coronal view shows the lesion displacing the cord to left.

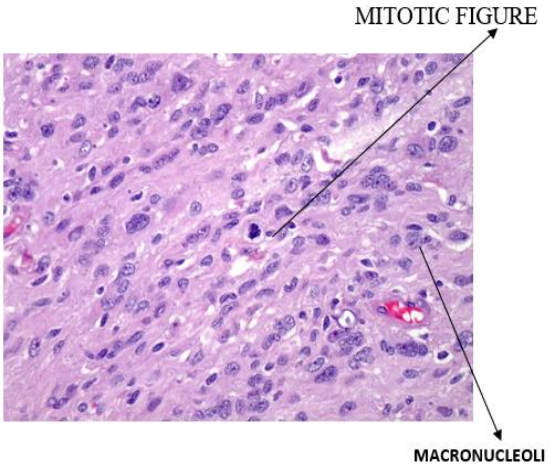

Figure 11: Section studied shows atypical meningioma, with hypercellularity, increased mitotic activity and macronucleoli

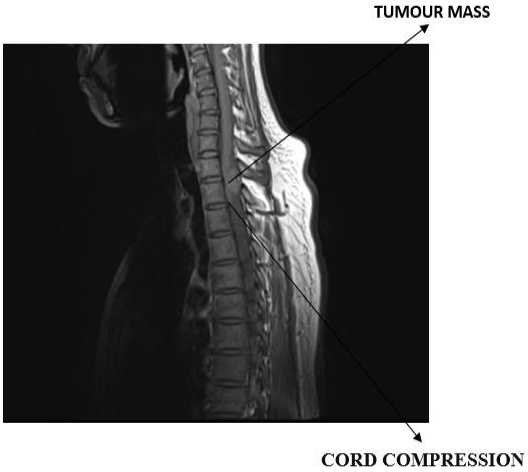

Figure 12: MRI shows a well defined enhancing intradural, extramedullary mass at the T2/T3 level causing severe compression. High signal foci in the cord in keeping with compression related oedema.

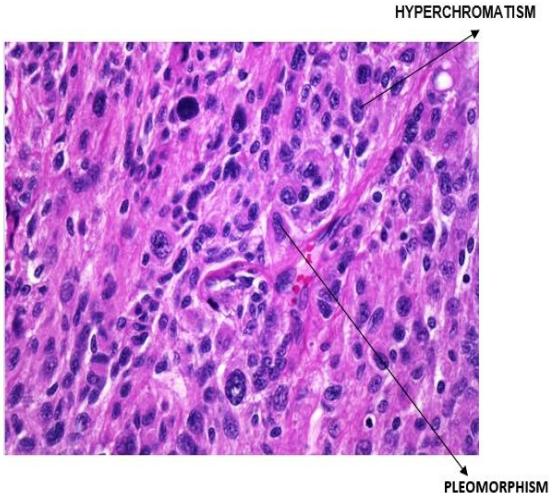

Figure 13: Section studied shows the tumour displays hypercellularity, prominent nucleoli, nuclear pleomorphism, and sarcoma-like morphology.

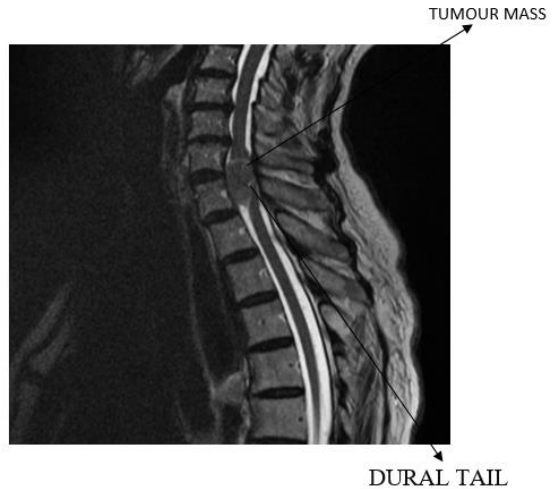

Figure 14: MRI shows a large extramedullary intradural mass at T1 level markedly compressing the spinal cord. It shows homogenous enhancement, heterogenous high signal on the T2 weighted sequence.

Section studied shows elongated cells and spindly nuclei. At the right upper corner, a fascicle has been cut horizontally. In this field the bland cytology of meningothelial cells is better appreciated. MRI shows a well-defined enhancing intradural extramedullary mass at the T2/T3 level causing severe compression. The histopathology and radiology correlation was perfect in all the three cases. [Figure 3 and 4]

Transitional Meningioma

Three cases of fibroblastic meningioma were reported. Three cases involving females and one involving male. The age group involved in females range from 56-68 years of age old and the age group male is 67 years of age old. Two cases involved thoracic region, one involved cervical region. All three cases underwent Simpson grade 1 resection. Microscopically these tumours have transition between meningothelial and fibrous meningioma. They maintain a lobular and fascicular arrangement. Whorls are striking and are tightly wound. These are often particularly rich in compact cellular whorls and endowed with psammoma bodies in significant numbers. Some tumours have large, distinct areas of meningothelial, fibrous and transitional regions mingle locally.

Section studied shows meningothelial cells with fibroblastic appearance on the right and forming syncytial structures on the left. Abundant pink cytoplasm, indistinguishable cell membranes and bland nuclear features can be readily noted. MRI scan shows a dural-based mass, located posterior to the thoracic cord, markedly compressing it. It is iso-intense to cord tissue on both T1 and T2 weighted images, and demonstrates vivid contrast enhancement. Dural tails are seen extending above and below the lesion. The histopathology and radiology correlation was perfect in all the three cases. [Figure 5 and 6]

Angiomatous meningioma

Two cases of angiomatous meningioma were reported. One case involving female and one involving male. The age group involved in female is 62 years of age old and the age group involved in male 56 years of age old. One case involved cervical region, one involved thoracic region angle. All two cases underwent Simpson grade 1 resection. One case underwent follow up stereotactic radiosurgery .Microscopically these tumours have numerous, conspicuous blood vessels with regions of classical meningothelial meningioma. The vascular channels may be small, medium sized and may be thin walled or have hyalinised thickened walls.

Section studied shows uniform evenly spaced meningothelial cells with indistinct borders, bland nuclear cytologic features, fine open chromatin, and inconspicuous nucleoli. Occasional hyperchromatic nuclei are present. Multiple ovoid to round shaped vascular spaces lined by a monolayer of endothelial cells can be noted. MRI shows an extramedullary, oval lesion at T10/11 level. It is isointense on T1 and there is moderate enhancement. The spinal cord is displaced anteriorly. The coronal view shows the lesion displacing the cord to left. The histopathology and radiology correlation was perfect in all the two cases. [Figure 7 and 8]

Psammomatous Meningioma

Seven cases of meningotheliomatous meningioma were reported. Six cases involving females and one case involving male. The age group involved in females range from 56-74 years of age old and the age involved in male was 59 years of age old. Six cases involved cervical region, one involved thoracic region and one case involved thoracic region. Six cases underwent Simpson grade 1 resection and one case underwent Simpson grade 2 resection one case underwent Adjuvant External Beam Radiotherapy Psammomatous meningioma is a histologic subtype of meningioma usually presented as a heavily calcified intracranial or spinal mass lesion. Microscopically these meningiomas have abundant psammoma bodies, the neoplastic cells have a transitional appearence with whorls. As psammoma bodies become large, they may lose circular shape and assume less regular shapes. They occur in the thoracic spinal region particularly in a middle aged women.

Section studied shows numerous psammoma bodies are seen in this variant. Psammoma bodies in the right one-third are more heavily calcified than the rest. MRI shows within the spinal canal at T9 is a slightly hyperintense on T1, iso-intense on T2 intensely enhancing extra medullary intra dural mass measuring 10 x 13 x 16 mm in orthogonal planes. The lesion displaces the spinal cord towards the right

with complete effacement of the CSF signal at this level and significant cord compression. The histopathology and radiology correlation was perfect in all the seven cases. [Figure 9 and 10]

Atypical Meningioma:

An atypical meningioma is more common in women of middle age or above 50 years of age. Microscopically atypical meningioma is characterised by multifocal, centrilobular forms of necrosis creating a low power microscopic impression similar to the pseudo palisading of tumour cells around necrosis. The absence of architectural pattern is referred to as 'sheeting'. Regions of hypercellularity and high nuclear: cytoplasmic ratio are seen in atypical meningioma. One finds irregular, small islands of dense cellularity with hyperchromatic nuclei and relatively inconspicuous cytoplasm otherwise called 'small cell formation' .The estimated recurrence rate for totally resected atypical meningiomas is about 40% at 5 years. Any of the following three criteria microscopically should be demonstrated for a diagnosis.

1. High mitotic index (e.g. ≥4 mitoses per 10 high power fields or ≥2.5/mm2)
2. Presence of at least three of the following four features:
   i. Sheeting architecture
   ii. Hypercellularity
   iii. Macro nucleoli
   iv. Small cell formation
3. Brain invasion

Two cases of atypical meningioma were reported. One case involving female and one involving male. The age group involved in female is 67 years of age old and the age group involved in male 56 years of age old. One cases involved cervical region, one involved thoracic region. All two cases underwent Simpson grade 2 resection. Two case underwent follow up Adjuvant External Beam Radiotherapy.
Well defined enhancing intradural, extramedullary mass at the T2/T3 level causing severe compression. High signal foci in the cord in keeping with compression related oedema.

Anaplastic Meningioma:

Anaplastic malignant meningioma microscopically shows patternless sheet like growth, a large number of mitoses, increased cellularity, focal necrosis, brain infiltration, pleomorphism and anaplasia. Anaplastic meningiomas are associated with recurrence rates of up to 50–80% after surgical resection and median survival is less than 2 years. One case of anaplastic meningioma were reported. The age group involved in female case is 68 years of age old. One case involved thoracic region. One case underwent Simpson grade 2 resection. One case died due to venous thromboembolism in the postoperative period.
MRI shows a large extramedullary intradural mass at T1 level markedly compressing the spinal cord. It shows homogenous enhancement, heterogenous high signal on the T2 weighted sequence.
Section studied shows the tumour displays hypercellularity, prominent nucleoli, nuclear pleomorphism, and sarcoma-like morphology. MRI shows a large extramedullary intradural mass at T1 level markedly compressing the spinal cord. It shows homogenous enhancement, heterogenous high signal on the T2 weighted sequence. The histopathology and radiology correlation was perfect in all the one case. [Figure 13 and 14]

MRI scans were obtained at pre-defined intervals, every 6 months for the first year and then yearly thereafter.

Table 6: Final Outcome of the Study
The grade 1 tumours meningothelial meningioma, psammomatous meningioma, fibroblastic meningioma, transitional meningioma, angioblastic meningioma responded well to treatment. The atypical meningioma and anaplastic meningioma did not respond to treatment.

Tumour	Surgery Done	Cure rate	Follow up
Meningothelial meningioma	Six cases underwent Simpson grade 1 resection and one case underwent Simpson grade 2 resection one case underwent Adjuvant External Beam Radiotherapy.	100 %	Seven cases are attending follow up.
Fibroblastic meningioma	Three cases underwent Simpson grade 1 resection	100 %	Three cases reported for follow up.
Transitional meningioma	Three cases underwent Simpson grade 1 resection.	100 %	Three cases reported for follow up.
Angiomatous meningioma	One case underwent Simpson grade 1 resection one case underwent Simpson grade 2 resection. One case underwent follow up Adjuvant External Beam Radiotherapy.	100 %	Two cases reported for follow up
Psammomatous meningioma	Six cases underwent Simpson grade 1 resection and one case underwent Simpson grade 2 resection one case underwent Adjuvant External Beam Radiotherapy.	100%	Seven cases turned for follow up.
Atypical meningioma	All two cases underwent Simpson grade 2 resection. Two case underwent follow up Adjuvant External Beam Radiotherapy	-	No cases reported for follow up after one year.
Anaplastic meningioma	One case underwent Simpson grade 2 resection. One case died due to venous thromboembolism.	-	Nil
Total	Twenty five cases underwent surgery. Four cases underwent follow up Adjuvant External Beam Radiotherapy		Twenty two cases turned for follow up.

DISCUSSION

Our study has similar findings with the literature including female predominance, operative, post-operative complications and age distribution.[15-19] One patient experienced VTE and died because of pulmonary embolism. Meningothelial and psammomatous meningiomas were the most common pathological subtypes of meningiomas. Based on the hypothesis, that the diffusion of water to and from the cells is highly dependent on the ratio of intracellular and extracellular space, DWI MRI Scan is used to differentiate the tumour grades.[20-22] Pathological examination revealed irreversible changes, including flattening of the anterior horn, disappearance and necrosis of anterior horn cells in the grey matter, and demyelination and axonal degeneration in the white matter High grade meningiomas are characterized by restriction of the water diffusion;[23] depicting as hyperintensity on DWI. Spectroscopy MRI Scan provides molecular information with regard to meningiomas and potentially aid in biopsy planning. In males, they are more likely to experience recurrence. The presence of a dural tail should be carefully analyzed in predicting recurrence. Patients exhibiting a dural tail on imaging need undergo long-duration follow-up, as late recurrence is a known phenomenon in large tumours with ventral attachment causing spinal cord compression. As suggested by some authors arachnoid scarring can also cause secondary progressive neurological deterioration after spinal intradural surgery.[24] As early as 1938, spinal meningioma surgery was described by Cushing and Eisenhardt as being ‘‘one of the most gratifying of all operative procedures’’.[25] When analyzed all pathological subtypes, the poor prognosis was found in anaplastic meningiomas, followed by atypical meningiomas. Stereotactic radiosurgery is a safe and effective treatment for spinal meningiomas with or without surgical resection. The following factors were prognostically positive: early diagnosis before the appearance of severe neurological symptoms, young age of the patients, total removal of the tumour, mild spinal cord compression, no intraoperative spinal cord retraction because of adequate surgical access, and the use of microsurgical techniques.

CONCLUSION

Group I meningioma demonstrated benign radiological, histopathological and clinical behaviour; group III demonstrated aggressive radiological, histopathological and clinical behaviour. Group II meningioma might be considered intermediate. Preoperative radiological classification can be used as a supplement to the histopathological grading. Adjuvant therapies like SRS can be beneficial for spinal meningiomas with severe spinal cord compression as total resection of those meningiomas may cause functional loss and they tend to be more benign. The planned combination of microsurgery and adjuvant GKRS extends the therapeutic spectrum in the treatment of spinal meningiomas. Through our experience with patients suffering from severe preoperative neurological deficits, we can conclude that a good functional outcome should be expected in the vast majority of cases, and that more than half of patients recovered totally after surgery. The study provides the importance of other medical faculty the Surgeon, Radiologist and Oncologist to work as a team for a successful outcome. We correlated the Histopathological findings with Radiological findings .This resulted in perfect correlation between the Histopathology study and Radiology study.

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How to cite this article: Samundeeswari RU, Kannan P. A Retrospective Study of Histopathology and Clinical Correlation of Spinal Meningioma at Thoothukudi Medical College, India. Ann. Int. Med. Den. Res. 2019; 5(5):PT01-PT11.

Source of Support: Nil, **Conflict of Interest:** None declared